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"WEATHER BASED IRRIGATION SCHEDULING IN SUMMER GROUNDNUT IN ODISHA CONDITION"

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ABSTRACT

An experiment was conducted at the Central Research Station of Orissa University of Agriculture and Technology, Bhubaneswar during summer season of 2015 to study the growth, yieldand moisture use of three groundnut varieties under different levels of irrigation (IW/CPE ratio of 1.0,0.8 and 0.6). The experiment was laid out in a split-plot design with three replications. Three Irrigation scheduling IW/CPE ratio (I_1- 1.0, I_2-0.8 and I_3- 0.6) were taken in the main plot and three groundnut varieties (V_1- Kadri -6, V_2- Devi ,V_3- Smruti) were assigned to sub-plots. The soil was silty clay having pH 5.45, available N, P and K of (150, 18.5, 107.5)kg/ha, respectively.

There was significant variation among irrigation levels with regards to shoot length, branch number, LAI, dry matter production and yield attributes viz. test weight of pod and kernel and shelling percentage were affected by both the factor which in turn influenced the yield. The irrigation level IW/CPE ratio 0.8 recorded significantly higher pod yield of 23.35 q/ha than that of 0.6 and 1.0 due to more number of filled pods (25 per plant) 100 pod weight (59.9g)and 100 kernel weight (50.0 g). Variety Devi recorded significantly higher pod yield of 23.33 q/ha.which is 28.2 % higher than that ofvariety AKP-7 and 11.5 % higher over variety Smruti.

KEYWORDS: This is in agreement with the findings of Baliarsingh and Mahapatra, (2015 a) &Baliarsingh and Mahapatra, (2015 b) Satapathy*et al*. (1992), Dash et. al. (2013)

INTRODUCTION

The oilseed production in India is not sufficient to meet the demand of vegetables oils and fats and 40% of the demand is met through import. Of the oilseed crops grown globally, groundnut is an important oilseed and food legume crop of tropical and sub-tropical parts. Groundnut kernel is a concentrated source of food, as it contains about 45% oil and 25% protein and rich in energy. It is considered as poor man almond due to high nutritional value. In the past two decades, the direct consumption of groundnut in India (roasted and salted groundnuts, chikki, peanut butter and sauce) has gone up to 35% and currently about only 45% of the produce is crushed for oil extraction. Major part of groundnut cake is fade to the domestic animals.

In India, groundnut is one of the important oilseed crops and occupies an area of 4.72 M ha with the production of 4.69 M tones and productivity of 996 kg/ha (DES, 2012-13),. India ranks first in the world in respect of area and second in production after in China. But the productivity (about 1000 kg/ha) of groundnut is quite low as compared to World average

productivity (1500 kg/ha).

It is the leading oilseed crop of Odisha which occupies 30.5% of the total oilseed area and accounts for 64.4% of total oilseed production in the state. It is grown in 263.4 thousand hectare with a production of 467.3 thousand tons and productivity of 1774 kg/ha (DAFP, 2012-13). The productivity both at our state label and national label is not satisfactory because, the crop gives an average yield of 3t/ha in USA and 2t/ha ton in China. This gap in productivity is due to the fact that the potentiality of the crop is not fully exploited by the Indian farmers due to many a factor, of which proper irrigation and suitable variety for a particular season need consideration. Identifying a suitable irrigation schedule and suitable variety may achieve a breakthrough in productivity.

Groundnut is grown during rainy, winter and summer seasons in India. The average productivity is relatively low in rainy season.. Groundnut has specific moisture needs due to its peculiar feature of producing pods underground. Some worker are of the opinion that early moisture stress restricts the vegetative growth which in turn reduces the yield, while others say that the peak flowering and pegging period is most sensitive as the peg cannot penetrate through dry and hard surface. The rabi crop avails the residual moisture and the scanty rainfall during winter and produces substantial yield as compared to the kharif crop and few supplementary irrigations would improve the yield. Because of high productivity under assured irrigation, groundnut cultivation in summer season is gaining popularity In irrigation scheduling, a climatologically approach based on IW/CPE ratio (IW- irrigation water, CPE- Cumulative pan evaporation) has been found most appropriate. This approach integrates all the weather parameters that determine water use by the crop and is likely to increase production at least 15-20%. Optimum scheduling of irrigation led to increase in pod yield and water use efficiency (WUE).(Taha and Gulati 2001).

Kadam and Patil (1989) were of the opinion that groundnut gave the highest pod yield with irrigation at 1.0 IW/CPE ratio rather than 0.7 or 0.5. But Satapathy and Patro (1992) found no significant effect of levels of irrigation on pod yield groundnut. Baliarsingh and Mahapatra (2015) found that irrigation at all the critical stages of groundnut produced maximum pod yield in summer groundnut, but the information on irrigation scheduling and suitable variety for summer season is meager. So the present experiment was conducted to study the effect of irrigation schedules and a variety for achieving higher yield in summer groundnut with following objectives.

OBJECTIVE OF THE THESIS

- To find out optimum irrigation schedule to achieve higher yield in summer groundnut.
- To find out the best summer groundnut variety for achieving higher yield.
- To find out the individual and combined effect of irrigation and varieties on growth and Yield of the crop.
- To estimate the water requirement, irrigation requirement and water use efficiency of the crop.

REVIEW OF LITERATURE

Considerable amount of research has been undertaken in India and abroad on the aspects pertaining to the present study in groundnut. An attempt has been made in this chapter to review the literature to formulate the research programme and to confirm the results wherever necessary.

Effect of Irrigation on Groundnut

Water is indispensable for plant life regardless of soil, climate and crop type and groundnut is no exception. It is much sensitive to both excess water as well as scarcity of water because, in the former case it causes poor aeration which in turn results in non availability of plant nutrients and poor microbial activity while in the later case, it causes poor physiological activity, stunted growth and low yield is the net out come in both the cases. So, it is essential to provide appropriate irrigation level to exploit the full potential of the crop.

Vegetative Growth

A larger share of water absorbed by the plants is used for their vegetative growth. Growth characters like shoot length, number of branches, number of leaves, leaf area index and dry matter production are affected by quantity and frequency of irrigation water.

Khatri and Patel (1983) stated that vegetative development is one of the critical stages for irrigation on groundnut.

Shoot Length

Lenka and Mishra (1973) reported that crop irrigated at different levels of soil moisture depletion had no differential effect on plant height while Mathew et. al. (1983) observed that the plant height increased with increase in irrigation level at IW/CPE ratios of 0.3, 0.6 and 0.9. Jana et. al. (1989) observed that when groundnut was irrigated at different growth stages, maximum plant length was recorded at 2 irrigations given one at flowering stage and the other at pod development stage. Satapathy et. al. (1992) stated that irrigation at W/CPE of 0.75 made the plants longer than those irrigated at IW/CPE of 0.5 or at three important growth stages, though not significant.

Number of Branches Per Plant

Mathew et. al. (1983) found that increased irrigation frequencies from 0.3 to 0.9 IW/CPE ratio, each with 50 mm of water exerted significant influence on the number of branches per plant. Water stress at IW/CPE ratio of 0.4 at seedling stage, flowering, pegging and maturity reduced the number of branches per plant (Shinde and Pawar, 1984). Desai et. al. (1985) made a comparison between the lowest number of 6 irrigations applied at 0.5 IW/CPE ratio and highest number of 11 irrigations applied at 1.1 IW/CPE ratio and reported that the reduction in number of primary branches was due to moisture stress, but Kumar et. al. (1987) did not find any significant difference in number of branches per plant by applying irrigation of different schedules such as 0.6 to 0.95 IW/CPE ratios or at different growth stages (sowing to pegging, pegging to pod formation and pod formation to maturity); similar results were also published by Satapathy et. al. (1992).

MATERIALS AND METHODS

The materials used and methods employed during the investigation have been given in detail in this chapter.

LOCATION

The experiment was conducted in the 'D' Block of the Central Research Station,Orissa University of Agriculture and Technology, Bhubaneswar during the summer season (February to May) of 2015 to study the effect of irrigation schedule and varieties on growth parameters and yield of summer groundnut.

EXPERIMENTAL SITE

The experimental site was a leveled patch with uniform top soil. It is situated at 20^0 15′N latitude and $85^0$52' E longitude with an elevation of 25.6metres above the mean sea level and at about 64 km west from the Bay of Bengal.

CLIMATE AND WEATHER

The climate is warm and moist characterized by humid summer and mild winter. In general, the climate of Bhubaneswar falls in the group of moist and hot category. The mean annual rainfall was 1502.4 mm. (1969 - 2005) with 105 rainy days. The monsoon sets in about middle of June and ceases by middle of October. The distribution of rainfall is uneven. Nearly 74% of total annual rainfall is received during the monsoon(June-September).

The average rainfall code is D_1 E_3 (B_1 A_2 B_1) C_1 D_1 E_2(Lenka, 1976). The mean maximum temperature was 32.5°C and the minimum was22.3°C(Table 3.1). The mean maximum temperature in the hottest month of May was 37.3^0C and the mean minimum temperature in the coldest month of December was14.7^{o}C. The mean relative humidity varied from 85% in August to 65% in December. The relative humidity was 90% during the morning and 57% during the afternoon hours. The bright sunshine hour varied from 4.2 hour (h) per day in July to 9.0 hour per day in February. he average bright sunshine hours per day was 7.4. The evaporation loss from the USWB Class 1 evaporimeter increasedgradually with increasing temperature reaching maximum in the month of May (254.2mm) and decreased in the subsequent months. It was lowest inthe month of December (102.3mm). The average wind speed was 6.5 km/hour.

The average weekly data (1969 to 2005) indicate that the total rainfall received during first 21 weeks was 166.3 mm (Table 3.2). The maximum temperature ranged from 27.7°C in the first week to 37.8°C during the 21st week. The minimum temperature was lowest (14.1°C) in thefirst week, which increased to 26.8°C in the 21st week. The relative humidity varied from 84% to 93% during the morning hours and 41% to 54% in the afternoon hours. The duration of bright sunshine varied from 8.4 to 9.2 hours per day, evaporation 22.4 to 58.8 mm per week and wind speed 3.2 to 14.0 km per hour.

Weather of the Growing Season

Monthly and weekly meteorological data for the cropping season from January to May in 2006 and 2007 are presented in Table 3.3. and 3.4a & b and Fig. 3.1a, b, c & d.

DISCUSSIONS

An experiment was conducted ton weather based irrigation scheduling in summer groundnut to study best irrigation scheduling and variety for achieving higher yield The observed data on growth, development, yield of pods, haulms, oil yield, consumptive use, water requirement, water use efficiency and economics are presented in the previous chapter. In this chapter an attempt has been made to have a critical discussion on the understanding of the cause and effect relationship of variations observed due to the treatments.

CROPS AND WEATHER

Groundnut has been the subject of much agricultural research because of its unpredictable nature that lie with the anatomy of flower, behavior of pedicels to curve downward, division of cells under the ovary, producing of peg, downward movement of peg, sideward movement of ovary and its maturity underground. These processes are complex and each step is affected by soil and atmospheric conditions.

It requires tropical, subtropical or warm temperate climates for optimum production. The approximate limits of its current commercial production lie between 40^{o}N to 40 ^{o} S.

In Indian groundnut-growing areas the annual rainfall varies from about 400-1500 mm, usually received between 2-4 rainy months. The groundnut growing areas have short (75-110 d) growing seasons and are characterized by intermittent drought periods. The amount of soil moisture in the surface soil is fairly restricted at the time of seed development and maturity, thus leading to pod development and harvesting problems. (Virmani and Singh, 1986).

The groundnut is distributed in the warm temperate zones of the world. It requires relatively high temperature for germination and rapid growth. In the present study during the cropping season, the crop received weekly average minimum temperature ranging from 21.85^{o}C to 29.42^{o}C during 2003 and from 20.20^{o}C to 27.89^{o}C during 2004 (Table 3.1b) which were close to the temperature required for growth of groundnut. The weekly average maximum temperature ranged from 26.28^{o}C to 33.24^{o}C and from 30.25^{o}C to 33.92^{o}C during 2003 and 2004 respectively which were also within the range of optimal temperature required for good growth of groundnut.

Lenka, 1998 has reported the mean air temperature of 25-30^{o}C for vegetative growth of groundnut and 20-25^{o}C for reproductive growth. If the groundnut crop is frequently subjected to the temperature more than 35^{o}C, particularly at the critical phenophases such as pegging, pod formation and pod development, the yield is adversely affected.

In the present study the crop received rainfall of 1342.3 mm in 46 rainy days and 872.5 mm in 36 rainy days during 2003 and 2004, respectively. Heavy cyclonic rainfall of 258.3 mm, during 5th to 9th October, 2003 was received by the crop which coincided with the late maturity stage. However, it did not have any adverse effect on its yield. The crop did not face any moisture stress during both the years (Table 3.1b).

The relative humidity ranged from 81.23 to 95.64 per cent in 2003 and from 73.42 to 92.73 per cent during 2004 in the morning and the afternoon relative humidity ranged from 74.46 to 90.25 per cent and from 65.61 to 86.71 during the respective years (Table 3.1b) which were considered favourable for its growth and development.

Study of different weather parameters temperature is the dominant factor controlling the rate at which the groundnut crop develops (De Beer, 1963 and Cox 1979) and diurnal temperature cycle is more important (Monteith, 1977) and with no such marked differences in climatic parameters during different phenophases as has been observed, the crop could be considered to have been grown under uniform weather conditions. Any variation in growth and development could be ascribed to causes and effects of variants of the experiment.

Plant Growth and Drymatter Production

Growth may be expressed as the division of a cell and the enlargement of the newly divided cell (Kramer, 1969). The plant height and number of branches increased at a faster rate upto 60 DAS which coincided with the vegetative phase

of the crop. Since the pods are borne from the axis of the stems, longer the branches and more their number, more is the possibility of pod formationIrrigation irrigation enhanced the growth of plant leading to more plant height. Plant height was shortened due to moisture stress because it inhibited cell enlargement more than cell division (Shao *et al*., 2008). The favourable effect of irrigation on plant height of groundnut was observed by Kumar *et al*. (1985) and Lourderaj (2000). Desai *et al*. (1985) also concluded that the plant height increased with the liberal supply of water throughout its growth period, which confirms the present finding

The number of branches increased with increasing moisture around the root zone. The crop irrigated at all the critical stages have maximum number of branches (6.27/plant) due to maintenance of optimum soil moisture condition enhancing the growth processes resulting in more number of branches and leaves. Leaf area index is a better determinant of crop growth, which determines the photosynthetic capacity of the crop (Watson, 1952). LAI was very low at 30 DAS because of low initial growth (Table 4.5). It increased gradually and reached its maximum at 90 DAS and decreased thereafter probably due to senescence. Leaf area index (LAI) is an important physiological attribute as it is directly associated with photosynthetic tissues of the plant (Hunt, 1990). Crop growth during early stage is often restricted because leaf area is too small to intercept all the incident radiation. In the experiment he leaf area index increased steadily and reached a maximum at 90 DAS and declined rapidly later because of advancement in growth, senescence of leaves and leaf fall.

Dry matter accumulation is the cumulative growth of various plant parts and acts as an important index of efficient photosynthetic activity. Pawar et al. (1991) and Nageswar Rao *et al.* (1985) reported that soil moisture stress at seedling, flowering, pegging and pod maturity stages resulted in drastic reduction in dry matter accumulation due to less numbers of leaves. The vegetative growth rate of a crop under water stress may be severely restricted, resulting in reduced total dry matter and smaller leaf area than where water is unlimited. In the present investigation the crop growth rate (CGR) was slow at the beginning and then increased rapidly upto 90DAS.The CGR was maximum at 60-90 DAS in all the treatments and decreased thereafter which was due to senescence of older leaves . In a clay- loam soil Gulati *.et al* .,(2001) peak values of CGR and NAR between 56 to 90days in summer ground nut at chipilima. Application of irrigation water ensures steady availability of soil moisture to crop, which consequently improve uptake of nutrient, fertilizer use efficiency, growth and development. It ultimately reflects on accumulation of higher dry matter in aerial parts (Dutta and Mandal, 2006) along with the high CGR, RGR and NAR.

YIELD AND YIELD ATTRIBUTES

In groundnut pod yield always depends upon number of pods/plant , kernels/pod and their weight, sound matured kernel percentage (SMK %) and shelling percentage. The increase in soil moisture levels reduces the soil strength (Gill, 1959) and facilitates the ease with which the soil can be deformed to accommodate the enlarging underground plant organs. This might be one of the reasons due to which good growth and development of pods were observed in crops subjected to adequate moisture supply either throughout the growing period of crop or during critical (38 DAS) period of peg formation and penetration, pod initiation and swelling (52 DAS).

In the present study, it was observed (Table) that the yield attributing characters like number of pods/plant (25.3) shelling percentage (67.8 %) . High soil moisture regime resulted in higher number of pods per plant. This was in agreement with the findings of Ike *et al*., (1986), Naveen *et al*., (1992) and Satpathy *et al*., (1992). Although

moisture stress adversely affected other yield components, the extent of reduction was maximum in case of number of pods per plant. The results thus indicated that the number of pods per plant was the most critical determinant of pod yield. Consequently, pod initiation was the most sensitive stage to water stress. Moisture stress at pod development and seed development stage reduced the weight of pod and kernel. Lowest 100-seed weight was recorded with the stress occurred at seed development stage. Yao *et al*., (1981) made similar observation. Beneficial effect of optimum soil moisture regime on pod yield was due mainly to more number of effective pods, seeds per plant, high test weight and shelling percentage in the present investigation.

MOISTURE STUDIES

Soil Moisture Depletion Pattern

The crop extracted maximum moisture (38 to 42.5 %) from surface (0 to 15 cm) layer which decreased with increase in death and minimum extraction (7.5 to 11.5%) was found from the deepest soil death (45 to 60 cm). Irrespective of irrigation schedule more amount of soil moisture by the crop from (0 to 15 cm) layer might be due to more root concentration in this layer. Taha and Gulati (2001) also reported similar findings in clay loam soil at Chipilima.

Crop Consumptive Use

The consumptive use increased from 407.1 mm to 508.3 mm with increase in IW/CPE from 0.6 to 1.0. This was due to increase in number of irrigation. It is in general agreement with the findings of Carlson *et al*. (1959) and Fulton (1970) who observed increased CU with irrigations and decrease CU with the dryness of soil. More availability of moisture in the root zone also helped the plant to absorb more water into its system. Creation of higher vapor pressure gradient between canopy air and atmospheric air might be response for greater evapotranspiration from frequently irrigated plots or higher IW/CPE. These results are in agreement with patel et al. (2008)

Water Requirement of Crop

The total water requirement by groundnut is controlled by climatic, agronomic and varietal factors as concluded by Lenka and Misra (1973) they reported that the total requirement ranged from 620 mm to 820 mm under sandy loam soil at Chipilima. The water requirement increased from 450 mm to 548 mm with increase in IW/CPE from 0.6 to 1.0. Taha and Gulati (2001) also reported similar findings in clay loam soil at Chipilima. The water requirement of all the verities tested was same and ranged from 49.5 cm to 49.8 cm. There is a narrow difference in the water requirement by the varieties. As there was no influence of the ground water table on groundnut crop in the present study, the total water requirement of the crop under various treatments was fully governed by the irrigation level, soil water contribution and effective rainfall during cropping season.

Water use Efficiency

The water use efficiency was a function of pod yield, which is determined by the weight of filled pods produced per unit amount of water. The water use efficiency was highest (52.01kg/ha cm) in IW/CPE 0.8 because it produced the highest pod yield of (2355 kg/ ha) than other irrigation schedules. Dash et al. (2013) also found highest water-use efficiency (41.5 kg/ha-mm) with IW/CPE 0.8 under in a sandy loam soil at chiplima

RESEARCH RESULTS

In this chapter the observations recorded during the course of investigation are presented and interpreted under the

following sections.

- Pre-harvest studies
- Post harvest studies
- Moisture studies

PRE-HARVEST STUDIES

The Plant height

The plant height is one of the important growth parameter, increased rapidly up to 60 DAS and there after the rate of growth in height became slower.

Among irrigation schedules application of irrigation at 0.8 IW/CPE resulted significant taller plant 45.82 cm which was 22% and 16% higher compared to IW/CPE ratio of 0.60 and 1.0 respectively (table 4.1) at variety Devi produced significantly tallest plant 4.26 cm which was 17% and 4% taller than Kadri – 6 and Smruti respectively. Interaction effect between irrigation and varieties was significant at 90 DAS J Variety Devi under 0.8 IW/CPE recorded talent plant of 47.43 cm (Table 4.1)

Number of branches per plant

The number of primary branches per plant increased progressively till harvest but the increase is more pronounced between 30 to 60 DAS (Table 4.3).

Irrigating at 0.8 IW/CPE produced highest number 5.64 branches per plant, which is significant different from other irrigation schedules Variety Devi produced significantly maximum number of branches per plant than other varieties, at harvest.

Leaf area Index

The leaf area index increased progressively up to 90 DAS and there after decreased drastically. The increase in LAI was higher between 60 to 90 DAS, and varied significantly. The LAI was maximum 7.13 at 90 DAS with irrigation schedule IW/CPE 0.8. variety Devi recorded significantly highest LAI 6.74 as compared to variety Kadri – 6 the lowest LAI 6.04, at 90 DAS (Table 4.4).

Dry matter accumulation.

Accumulation of dry matter per plant increased progressively from 30 DAS to 90 DAS and was maintained thereafter up to harvest.

Both irrigation schedule and varieties significantly affected Dry matter production per plant at all the stages of growth.

Irrigation schedule IW/CPE 0.8 recorded significantly highest dry matter 17.75 g/ plant and variety Devi recorded significantly highest dry matter of 15.84 g/plant at harvest (Table 4.6)

Flower Initiation

There was no significant difference between the irrigation schedule and varieties on the period of flower initiation.

It ranged from 28.2 to 29.2 days after sowing. (Table 4.7). Iirrigation at IW/CPE 1.j0 came to flowering earliest at 28.2 DAS and in variety Devi flowering occurred at the earliest 28.1 DAS.

Crop growth rate (CGR)

The crop growth rate was influenced by irrigation schedule and varieties at different stages of crop growth. Initially it was flower but increased at a faster rate between 60 – 90 DAS. Thereafter became flower till harvest.

Application of irrigation schedule at IW/CPE at 0.8 recorded significantly highest crop growth rate 19.96 gm^{-2} day^{-1}.

Among the varieties 'Devi' had the highest crop growth rate of 17 .90 gm^{-2} day^{-1} Smr at par with Smruti (17.40 gm^{-2} day^{-1}) but of significantly different from kadri-6 with C.G.R 15.33 g m^{-2} day^{-1} (Table 4.8).

Relative Growth rate (RGR)

The irrigation schedules and varieties influenced the relative growth rate. The RGR increased up to 90 days and decreased thereafter. The RGR was maximum during 60-90 days after sowing. (Table 4.9).

Number of Pegs of Pods per Plant

Number of pegs/plant at 60 DAS and number of filled pods/plant (at harvest) are presented in table 4.10.

Scheduling Irrigation at IW/CPE 0.8 recorded significantly highest 35.71 number of pegs/plant at 60 DAS. Than IW/CPE 1.0 and 0.6 IW/CPE at 0.6 produced the lowest number (25.22) pegs/plant. Variety Devi produced highest number of pegs 33.62. per plant which is significants different from variety smruti (30.38) and Kadri – 6 (27-30) number of pegs /plant. The interaction effect of irrigation scheduling and varieties on the number of pegs/plant is significant. Varieties 'Devi' produced 38.43 number of pegs/plant irrigated at IW/CPE 0.8.

Irrigation at IW/CPE 0.8 recorded highest 22.04 number of pods/plant variety 'Devi' produced significantly highest number of 21.17 pods/plant followed by Smruti 18.97 pods/plant and Kadri -6 (14.90) pods/plant.

Post Harvest Studies

Observation on effect of irrigation schedules and varieties on various yield attributing characters like pod weight per plant, 100 pod weight, 100 kernel weight and shelling percentage are presented in table 4.12.

Pod weight per plant

Irrigation schedules significantly affected the pod weight per plant (Table 4.12). Irrigation at IW/CPE 0.8 recorded significantly highest 14.5 number of pods/plant. Variety Devi produced significantly highest 13.8 g pod weight/plant.

100-pod weight:

Significant difference in 100 pod weight was recorded for both irrigation schedule and varieties.

Irrigation at IW/CPE ratio 0.8 recorded the highest text weight of 59.9 g/100 pod, which is significant different than all other levels of irrigation.

Variety Devi recorded the highest text weight of 59 g/100 pod which is significantly different from variety Smruti and

Kadri-6 which is 56.1 g and 45.0 g per 100 pod (Table 4.12).

The interaction effect of irrigation schedule and varieties on 100 pod weight was observed. (Table-4.13). Variety 'Devi' irrigated at IW/CPE 0.8 recorded the highest 65.9 g/100 pod which was significantly different from Smruti (63.5g/100 pod) and Kadri-6 (50.4 g/100 pod).

100 Kernel weight

Irrigation at IW/CPE 0.8 recorded highest 50 g/100 Kernel weight, which is significantly different from other irrigation schedules. Variety Smruti recorded 51.8 f/100 kernel weight which is significantly different from variety Devi and Kadri-6 (Table-12).

The interaction effect of irrigation schedules and varieties on 100 kernel weight is presented in table 4.41.

Variety 'Smruti' recorded the highest 53.4 g/100 kernel weight when irrigated at IW/CPE 0.8 significantly different from other treatment combination. (Table 4.41)

Shelling percent

Among the irrigation schedules IW/CPE 0.8 recorded the highest shelling percentage (67.8%) which is at par with IW/CPE 1.0 but different to IW/CPE 0.6. Variety Devi recorded highest (66.8%) shelling percentage which is significantly different from other varieties Kadri-6 (64.2%) and Smruti (65.8%). (Table 4.12)

Pod yield

The irrigation schedules and varieties influenced the pod yield significantly (Table 4.15). Irrigation schedule IW/CPE 0.8 produced significantly highest pod yield of 2355 kg/ha. Over other irrigation schedules which was 13.6 and IW/CPE 1.0 and 0.6 respectively. Variety Devi produced the significantly highest pod yield of 2323 kg/ha which was 11% and 27.6% higher yield over variety Smruti and Kadri-6 respectively.

The interaction effect of irrigation schedule and varieties on pod yield was significant. Variety Devi irrigated at IW/CPE 0.8 recorded 2600 kg pod/ha which is significantly different from other treatment combinations (Table 4.16)

Haulm yield

The irrigation schedule and varieties influenced the haulm yield significantly.

Irrigating at IW/CPE 0.8 produced significantly highest haulm yield of 4742 kg/ha which was 10.8% and 28.5% higher over IW?CPE 1.0 and IW/CPE 0.6 respectively. Variety 'Devi' produced significantly higher haulm yield of 4595 kg/ha which was at par with Smruti and 23.2% higher over Kadri-6. (Table-4.15).

Harvest Index

Harvest index did not different significantly due to irrigation schedule and varieties. (Table 4.15). Irrigation at IW/CPE 0.8 recorded highest harvest index 33.2% which is at par with other irrigation schedules varieties. 'Devi' recorded the highest harvest index 33.7% which was at par with harvest index percentage recorded by Smruti and Kadri-6.

Moisture use studies

Seasonal Consumptive Use (CU) of water

The consumptive use (CU) of water by the groundnut crop increased progressively and marked by with the increase in IW/CPE ratio. (Table 17)

The crop irrigated at IW/CPE 1.0 consumed maximum amount of water (508.3 mm) through 7 irrigation. The varieties consumed almost same amount of water. Though varieties 'Smruti' consumed highest water (462.2 mm) through 5 irrigations.

The interaction effect of irrigation and varieties presented in table 4.18 revealed that higher consumptive use was recorded by IW/CPE 1.0 .(Table 4.18)

Daily Moisture use rate (DMUR)

Daily Moisture use rate progressively increased with increase in level of irrigation. (Maximum 5.86 mm/day) being with IW/CPE 1.0 and minimum 4.16 mm/day with IW/CPE 0.6 (Table 4.18)

Water use efficiency (WUE)

Water use efficiency estimated for pod yield gradually increased from IW/CPE 0.6 (44.63 kg/ha-cm) to IW/CPE 0.8 (52.01 kg/ha-cm). then decreased to 40.73 kg/ha-cm with IW/CPE 1.0

Variety Devi recorded highest water use efficiency 50.78 kg/ha-cm. which was 10.9/and 23.6% higher than Smruti and Kadri -6 respectively. (Table 21)

Water requirement (WR)

Water requirement of groundnut increased gradually with increasing irrigation schedule. Highest water requirement for Irrigation at IW/CPE 1.0 was 548.3 mm which was 10.8% and 21.7% higher over IW/CPE 0.8 and 0.6 respectively. Water requirement for variety Devi was 497.5 mm. water requirements for other two varieties are almost same as variety Devi. (Table 4.19

Moisture extraction Pattern

Irrespective of the treatments the percent extraction of Soil moisture decreased. With increase in the profile depth about 40-42% total soil moisture utilized by the crop, was extracted from 0-15 cm Soil layer and another 31-32% from 15-30 cm layer. (Table 4.20) crop receiving irrigation at lower levels up to 0.6 IW/CPE utilized more quantity of water from deeper soil layer (45-60 cm) compared to IW/CPE 1.0

Benefit- Corp ratio (B.C – ratio)

Irrigation schedule IW/CPE 1.0 recorded highest gross return (Rs. 58,888/-ha) net return (Rs. 40883/ha) as Benefit : Cort ratio 2.27 varieties Devi recorded the highest gross return Rs. 58333/ha, Net return Rs. 4033/ha as B:C ratio 2.24.

CONCLUSIONS

It is concluded that irrigating groundnut with IW/CPE 0.8 produced maximum pod yield of 2355 kg/ha and haulm 4742 kg/ha. Harvest index (33%). It gave highest gross return of Rs. 58,888/ha., net return of Rs. 40,883/ha and benefit-cost ratio of 2.27. The consumptive use of water was 452 mm water requirement of 495 mm and water use efficiency 52%. Variety Devi produced maximum pod yield of 2333 kg/ha and haulm 4595 kg/ha. and harvest index (33.7%). It gave

highest gross return of Rs. 58,333/ha., net return of Rs. 40,333/ha and benefit-cost ratio of 2.24. The consumptive use of water was 460 mm and water requirement of 508 mm and water use efficiency 51%. Hence, IW/CPE ratio of 0.8 and variety Devi may be considered optimum for summer groundnut under silty clay soil of Bhubaneswar.

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